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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,838	10/08/2004	Pei-Yu Chou	13869-US-PA	5837

31561 7590 05/18/2006

JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE
7 FLOOR-1, NO. 100
ROOSEVELT ROAD, SECTION 2
TAIPEI, 100
TAIWAN

EXAMINER

CHEN, ERIC BRICE

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 05/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,838

Applicant(s)

CHOU, PEI-YU

Examiner

Eric B. Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 25, 2006 has been entered.

Claim Rejections - 35 USC §103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2, and 4-6 are rejected under 35 U.S.C. 103(a) as obvious over Kropewnicki et al. (U.S. Patent No. 6,440,864), as evidenced by Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002).

4. As to claim 1, Kropewnicki discloses an etching process, comprising: providing a material layer having a bottom anti-reflection coating (BARC) (45) (column 3, lines 40-41; column 5, lines 60-61) and a patterned photoresist layer (50) thereon (column 3, lines 40-41; Figure 1A); etching the BARC (45) using the patterned photoresist (50)

layer as a mask (column 3, lines 42-47; Figure 1B), wherein polymer (60) as an etching by-product is formed on the patterned photoresist layer (50) (column 3, lines 48-51); performing a cleaning step to remove the polymer (60) from the patterned photoresist layer (50) (column 3, lines 52-55; column 6, lines 52-59).

5. It should be noted that dielectric layer (45) is composed of silicon nitride, which inherently functions as a bottom anti-reflection coating (BARC). In the alternative, Applicants' claimed layer, would have obviously functioned as a bottom anti-reflection coating (BARC) because Kropewnicki discloses that dielectric layer (45) is composed of silicon nitride, and Wolf teaches that silicon nitride is commonly used as an effective inorganic BARC (page 249). See *In re Best*, 195 USPQ 430, 433, n.4 (CCPA 1977).

6. Kropewnicki does not expressly disclose etching the material layer (40) using the patterned photoresist layer as a mask, wherein the cleaning step is performed before the step of etching the material layer. However, following the cleaning step to remove the polymer (60) (column 3, lines 52-55), Kropewnicki discloses that subsequent processing steps are performed (column 3, lines 53-55). Kropewnicki further teaches that forming integrated circuits involves etching silicon oxides, polysilicon, and metal compounds by patterning a resist layer and etching the adjacent regions to form either gates, vias, or contact holes (column 1, lines 5-15). Thus, from Figure 1C, there is a suggestion that subsequent processing steps include patterning polysilicon layer (40) (column 3, line 22) with patterned resist layer (50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to etch the material layer (40) using the patterned photoresist layer as a mask, wherein the

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cleaning step is performed before the step of etching the material layer. One who is skilled in the art would be motivated to form the gates, vias, or contact holes for a semiconductor device.

7. As to claim 2, Kropewnicki discloses that the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer (column 6, lines 52-59).

8. As to claim 4, Kropewnicki discloses that the material layer (45) comprises a polysilicon layer (column 3, line 22).

9. As to claim 5, Kropewnicki discloses that the ionized gas contains fluorine ions, oxygen ions, or a combination hereof (column 6, lines 52-59).

10. As to claim 6, Kropewnicki discloses that the BARC (16) comprises an inorganic material (column 5, lines 60-61).

Claim Rejections - 35 USC § 103

11. Claims 8-10 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kropewnicki, in further view of Mui et al. (U.S. Patent Appl. Pub. No. 2003/0228532).

12. As to claim 8, Kropewnicki does not expressly disclose trimming the patterned photoresist layer after the material layer is provided. However, Mui teaches that the optical limitations to the lithographic process may not allow the transfer of a feature to photoresist, if the feature is smaller than the optical resolution of the lithographic process (paragraph 0008). To overcome optical limitations, dimensions of features can

be further reduced by photoresist trimming (paragraph 0009). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to trim the patterned photoresist layer. One who is skilled in the art would be motivated to overcome the limitations of optical resolution to achieve smaller dimensions by photoresist trimming.

13. As to claim 9, Kropewnicki discloses a patterning process, comprising: sequentially forming a bottom anti-reflection coating (BARC) (45) (column 3, lines 40-41; column 5, lines 60-61) and a photoresist layer (50) on a material layer (40); performing a lithography process to pattern the photoresist layer (50) (column 3, lines 39-41; Figure 1A); etching the BARC (45) using the patterned photoresist layer (50) as a mask (column 3, lines 42-47; Figure 1B), wherein polymer (60) as an etching by-product is formed on the patterned photoresist layer (50) (column 3, lines 48-51); and performing a cleaning step to remove the polymer (60) from the patterned photoresist layer (50) (column 3, lines 52-55; column 6, lines 52-59).

14. Yin does not expressly disclose trimming the patterned photoresist layer. However, Mui teaches that the optical limitations to the lithographic process may not allow the transfer of a feature to photoresist, if the feature is smaller than the optical resolution of the lithographic process (paragraph 0008). To overcome optical limitations, dimensions of features can be further reduced by photoresist trimming (paragraph 0009). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to trim the patterned photoresist layer. One who is skilled

in the art would be motivated to overcome the limitations of optical resolution to achieve smaller dimensions by photoresist trimming.

15. It should be noted that dielectric layer (45) is composed of silicon nitride, which inherently functions as a bottom anti-reflection coating (BARC). In the alternative, Applicants' claimed layer, would have obviously functioned as a bottom anti-reflection coating (BARC) because Kropewnicki discloses that dielectric layer (45) is composed of silicon nitride, and Wolf teaches that silicon nitride is commonly used as an effective inorganic BARC (page 249). See *In re Best*, 195 USPQ 430, 433, n.4 (CCPA 1977).

16. Kropewnicki does not expressly disclose etching the material layer (40) using the patterned photoresist layer as a mask, wherein the cleaning step is performed before the step of etching the material layer. However, following the cleaning step to remove the polymer (60) (column 3, lines 52-55), Kropewnicki discloses that subsequent processing steps are performed (column 3, lines 53-55). Kropewnicki further teaches that forming integrated circuits involves etching silicon oxides, polysilicon, and metal compounds by patterning a resist layer and etching the adjacent regions to form either gates, vias, or contact holes (column 1, lines 5-15). Thus, from Figure 1C, there is a suggestion that subsequent processing steps include patterning polysilicon layer (40) (column 3, line 22) with patterned resist layer (50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to etch the material layer (40) using the patterned photoresist layer as a mask, wherein the cleaning step is performed before the step of etching the material layer. One who is

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skilled in the art would be motivated to form the gates, vias, or contact holes for a semiconductor device.

17. Kropewnicki does not expressly disclose the step of etching the BARC, the cleaning step and the step of etching the material layer are performed in-situ.

Kropewnicki discloses that the process in a multi-chamber apparatus (70) in which the substrate (30) is transferred from one chamber to the next (column 3, lines 56-67; Figure 2). However, in the absence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the step of etching the BARC, the cleaning step and the step of etching the material layer in-situ. One who is skilled in the art would be motivated to streamline the processing of the substrate, including eliminating the steps of transferring the substrate from chamber to chamber.

18. As to claim 10, Kropewnicki discloses that the cleaning step comprises using an ionized gas to remove the polymer from the patterned photoresist layer (column 6, lines 52-59).

19. As to claim 12, Kropewnicki discloses that the material layer (45) comprises a polysilicon layer (column 3, line 22).

20. As to claim 13, Kropewnicki discloses that the ionized gas contains fluorine ions, oxygen ions, or a combination hereof (column 6, lines 52-59).

21. As to claim 14, Kropewnicki discloses that the BARC (16) comprises an inorganic material (column 5, lines 60-61).

Claim Rejections - 35 USC § 103

22. Claims 3 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kropewnicki, in view of Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, Lattice Press (1986) ("Wolf I").

23. As to claims 3 and 11, Yin does not expressly disclose that the ionized gas has a higher etching rate to the polymer than to the material layer. Wolf I teaches that both the mask material and underlying material are subjected to etchant attack during etching (page 523). Moreover, Wolf I teaches that selectivity of the etch process is an important characteristic to the etch process (page 523). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select an ionized gas with a higher etching rate to the polymer than to the material layer. One who is skilled in the art would select a selectivity targeted for the removal of the desired film.

Claim Rejections - 35 USC § 103

24. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kropewnicki, in view of Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002) ("Wolf IV").

25. As to claims 7 and 15, Yin does not expressly disclose that the BARC comprises an organic material. However, Wolf IV teaches that the application of organic BARCS have the advantages of low cost, refractive index reproducibility, planarization capability, film thickness tolerance, rework capability, and surface control (page 248).

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Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an organic BARC. One who is skilled in the art would be motivated to use an organic BARC, due to its many advantages.

Response to Arguments

26. Applicant's arguments (Applicant's Remarks, pages 7-8), filed April 25, 2006, with respect to the rejection of claims 1 and 9 under 35 U.S.C. 103(a) as unpatentable over the Chen reference have been fully considered and are persuasive. Applicant has presented evidence (page 7, last paragraph; SEM images; page 8, first paragraph) to rebut the *prima facie* case of obviousness, the assertion that the transposition of process steps (i.e., performed before the step of etching the material layer), where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Kropewnicki.

27. Applicant's arguments (Applicant's Remarks, pages 8-9), filed April 25, 2006, with respect to claims 2-8 and 10-14 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-

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2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC
May 11, 2006

NADINE NORTON
SUPERVISORY PATENT EXAMINER 1765
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